Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences. 2022 Apr 16; 10(G):504-508.
https://doi.org/10.3889/oamjms.2022.8834
eISSN: 1857-9655
**Category:** *G - Nursing*
***Section:*** *Nursing in Internal Medicine*



# Determinants of Hypertension Proxy in Community, Indonesia

Ni Wayan Sridani[1]*, Hayati Palesa[1], Muhammad Sabir[2], Muhammad Ardi Munir[2], Tri Setyawai[2], Fauzan Fauzan[1], Ratna Devi[1]

[1]*Department of Nursing, Tadulako University, Palu, Indonesia; 2Department of Medicine, Tadulako University, Palu, Indonesia*

**Edited by:** Sasho Stoleski
**Citation:** Sridani NW, Palesa H, Sabir M, Munir MA, Setyawai T, Fauzan F, Devi R. Determinants of Hypertension Proxy in Community, Indonesia. Open Access Maced J Med Sci. 2022 Apr 16; 10(G):504-508. https://doi.org/10.3889/oamjms.2022.8834
**Keywords:** Determinant of proxy; Hypertension; Genetics and gender
***Correspondence:** Dr. Ni Wayan Sridani, Department of Nursing, Tadulako University, Palu, Indonesia. E-mail: niwayansridani@yahoo.com
**Received:** 31-Jan-2022
**Revised:** 23-Feb-2022
**Accepted:** 06-Apr-2022

**Funding:** This research did not receive any financial support
**Competing Interests:** The authors have declared that no competing interests exist


**Abstract**

**BACKGROUND:** Hypertension is a high-risk health problem and leads to cardiovascular diseases such as heart attack, heart failure, stroke, and kidney disease.

**AIM:** This study aimed to determine the proxy determinants of hypertension in the Kawatuna community.

**METHODS:** An observational analytic study with a cross-sectional approach, with a population of 2943 people, and the sample was taken using the Slovin formula; the sample size was 352 respondents by purposive sampling. Bivariate data analysis used the Chi-square test at a significance level of p = 0.05 and analyzed the relationship between the multivariate determinant variables with logistic regression analysis.

**RESULTS:** The significant variable on the incidence of prehypertension was the genetic variable with p = 0.043 and RRR = 2.31. The variables that had a significant relationship with the incidence of hypertension were genetics with a p = 0.000 and gender with a p = 0.012. Respondents with a family history of hypertension had a greater risk of 5.9 times than those without family hypertension. The male gender had a risk of 3.68 times compared to female respondents.

**CONCLUSION:** The determinants of hypertension proxy in the Kawatuna community are genetics and gender.

## Introduction

Hypertension or high blood pressure disease is a persistent elevation of systolic blood pressure at a level of 140 mmHg or more and diastolic blood pressure at a level of 90 mmHg or more [1]. Hypertension is a health problem with a systolic blood pressure of more than 140 mmHg and diastolic blood pressure of more than 90 mmHg, with symptoms that vary, ranging from headaches, blurred vision, irritability, difficulty sleeping, chest pain, dizziness, strong-fast heart rate fast [2]. According to World Health Organization, hypertension is at risk and leads to cardiovascular diseases such as heart attacks, heart failure, stroke, and kidney disease which is often found in almost every country [3]. Similarly, in Indonesia, National Basic Health Research *(Riset Kesehatan Dasar)* data show that hypertension in Indonesia has increased from 25.8% in 2013 to 34.1% in 2018 [4].

Based on Central Sulawesi Province's Basic Health Research data (Riskesdas, 2018). Degenerative diseases or Non-Communicable Diseases, hypertension ranks 1$^{st}$ in the number of diseases in Central Sulawesi from 2016 to 2020, with 29.75% sufferers [4]. This shows that there will be an increase in the number of complications of hypertension sufferers in Central Sulawesi. Meanwhile, based on the screening results conducted by the researchers in Kawatuna Village in 2020, from 352 samples, only 100 normal blood pressure (28.41%), 166 people (47.76%), stage 1 hypertension, 59 people suffered from prehypertension. People (16.76%), stage 2 hypertension as many as, 27 people (7.67%).

The high prevalence of hypertension in Kawatuna Village can be caused by population growth and behavioral risk factors, such as an unhealthy diet, excessive alcohol use, lack of physical activity, being overweight and constant exposure to stress. Several behavioral risk factors are related to hypertension, namely the consumption of foods that contain too much salt and fat, lack of fruit and vegetables, alcohol consumption, lack of physical activity and exercise, poor stress management, and smoking behavior. Then, socioeconomic factors such as income, education, and housing harm behavioral risk factors, affecting the development of hypertension. The absence of work will impact stress levels, which affects high blood pressure. Genetic factors can also play a role, and when hypertension develops in people under the age of 40, it is crucial to exclude secondary causes such as kidney disease, endocrine disease, and vascular malformations [5]. Psychosocial factors may also contribute to the increased incidence of hypertension in the younger population [6].

The cases of prehypertension and hypertension in the Kawatuna sub-district are quite

high, so the researchers are interested in researching the determinants of hypertension proxies in the Kawatuna sub-district, Mantikulore sub-district, Palu City. The research aimed to find out the determinants of hypertension proxies in the community in Kawatuna Urban-Village, Mantikulore District, Palu City.

**Table 1: Characteristics of respondents**

| Variable | *n* (%) |
|---|---|
| Sex | |
| Female | 231 (65.6) |
| Male | 121 (34.4) |
| Genetic | |
| No | 294 (83.5) |
| Yes | 58 (16.5) |
| Age | |
| Teenager | 31 (8.8) |
| Adults | 297 (84.4) |
| Elderly | 24 (6.8) |
| Education | |
| Low | 45 (12.8) |
| High | 307 (87.2) |
| Work status | |
| Work | 157 (44.6) |
| Not working | 195 (55.4) |
| Income | |
| Enough | 56 (15.9) |
| Less | 296 (84.1) |
| Body weight | |
| Normal | 255 (72.4) |
| Thin | 27 (7.7) |
| Overweight | 70 (19.9) |
| Eating patterns | |
| No risk | 44 (12.5) |
| Risk | 308 (87.5) |
| Physical exercise | |
| Good | 92 (26.1) |
| Less | 260 (73.9) |
| Smoke | |
| No | 278 (79) |
| Yes | 74 (21) |
| Drink alcohol | |
| No | 350 (99.4) |
| Yes | 2 (0.6) |
| Stress | |
| No | 260 (73.9) |
| Mild | 47 (13.4) |
| Moderate | 45 (12.8) |
| Hypertension | |
| Normal | 240 (68.2) |
| Pre-hypertension | 58 (16.5) |
| Hypertension | 54 (15.3) |
| Total | 352 (100) |

## Methods

The type of research used an observational analytic study with a cross-sectional approach, where researchers wanted to identify proxy determinants of hypertension with independent variables, namely personal determinants (type of disorder, genetics, and age), socioeconomic determinants (education, occupation, and income), behavioral determinants (weight, diet, smoking, drinking alcohol, exercise, and stress) in Kawatuna Urban-Village, Mantikulore Sub-District, Palu City, during June–August 2021. With 2943 people, samples were taken using the Slovin formula to obtain a sample size of 352 respondents. The sampling method was purposive sampling with the following criteria: willing to become respondents; respondents should be 15 years and over; not currently suffering from DM, cardiovascular, kidney, and preeclampsia diagnosed by a doctor. The measuring instruments used were a questionnaire, an Omron brand of tensimeter (calibrated), a stethoscope, a Gea brand of the weight scale (calibrated), and Metlit (to measure height). Bivariate data analysis used the Chi-square test at a significance level of p = 0.05 and analyzed the relationship between the multivariate determinant variables with logistic regression analysis. This research had obtained permission from the Ethics Test of the Faculty of Medicine, the University of Tadulako, with Number: 2845/UN 28.1.30/KL/2021.

## Results

Table 1 shows the number of respondents, as many as 352 people, including 231 female and 121 male respondents. The results showed that most of the respondents' age group was in the adult category, namely 84.4% (297 respondents). The majority have high education was 307 respondents (87.2%), with the majority work status not working was 195 respondents (55.4%). The majority of risky eating patterns were 308 respondents (87.5%), the majority lacked exercise, as many as 260 respondents (73.9%), and a history of hypertension was 54 respondents, prehypertension was 58 respondents, and normal was 240 respondents.

**Table 2: Cross tabulation of characteristics with hypertension status**

| Variable | Status hypertension | | | Total, *n* (%) | p |
|---|---|---|---|---|---|
| | Normal, *n* (%) | Pre-hypertension, *n* (%) | Hypertension, *n* (%) | | |
| Sex | | | | | |
| Female | 168 (72.70) | 28 (12.10) | 35 (15.20) | 231 (100.00) | 0.007 |
| Male | 72 (59.50) | 30 (24.80) | 19 (15.70) | 121 (100.00) | |
| Genetic | | | | | |
| No | 215 (73.10) | 46 (15.60) | 33 (11.20) | 294 (100.00) | 0.000 |
| Yes | 25 (43.10) | 12 (20.70) | 21 (36.20) | 58 (100.00) | |
| Age | | | | | |
| Teenager | 28 (90.30) | 3 (9.70) | 0 (0.00) | 31 (100.00) | 0.000 |
| Adults | 206 (69.40) | 52 (17.50) | 39 (13.10) | 297 (100.00) | |
| Elderly | 6 (25.00) | 3 (12.50) | 15 (62.50) | 24 (100.00) | |
| Education | | | | | |
| Low | 32 (71.10) | 5 (11.10) | 8 (17.80) | 45 (100.00) | 0.558 |
| High | 208 (67.80) | 53 (17.30) | 46 (15.00) | 307 (100.00) | |
| Work status | | | | | |
| Work | 100 (63.70) | 35 (22.30) | 22 (14.00) | 157 (100.00) | 0.030 |
| Not working | 140 (71.80) | 23 (11.80) | 32 (16.40) | 195 (100.00) | |
| Income | | | | | |
| Enough | 34 (60.70) | 13 (23.20) | 9 (16.10) | 56 (100.00) | 0.301 |
| Less | 206 (69.60) | 45 (15.20) | 45 (15.20) | 296 (100.00) | |
| Body weight | | | | | |
| Normal | 177 (69.40) | 40 (15.70) | 38 (14.90) | 255 (100.00) | 0.707 |
| Thin | 20 (74.10) | 4 (14.80) | 3 (11.10) | 27 (100.00) | |
| Overweight | 43 (61.40) | 14 (20.00) | 13 (18.60) | 70 (100.00) | |
| Eating patterns | | | | | |
| No risk | 28 (63.60) | 8 (18.20) | 8 (18.20) | 44 (100.00) | 0.777 |
| Risk | 212 (68.80) | 50 (16.20) | 46 (14.90) | 308 (100.00) | |
| Physical exercise | | | | | |
| Good | 68 (73.90) | 15 (16.30) | 9 (9.80) | 92 (100.00) | 0.211 |
| Less | 172 (66.20) | 43 (16.50) | 45 (17.30) | 260 (100.00) | |
| Smoke | | | | | |
| No | 196 (70.50) | 35 (12.60) | 47 (16.90) | 278 (100.00) | 0.000 |
| Yes | 44 (59.50) | 23 (31.10) | 7 (9.50) | 74 (100.00) | |
| Drink alcohol | | | | | |
| No | 238 (68.00) | 58 (16.60) | 54 (15.40) | 350 (100.00) | 0.625 |
| Yes | 2 (100.00) | 0 (0.00) | 0 (0.00) | 2 (100.00) | |
| Stress | | | | | |
| No | 182 (70.00) | 38 (14.60) | 40 (15.40) | 260 (100.00) | 0.383 |
| Mild | 31 (66.00) | 11 (23.40) | 5 (10.60) | 47 (100.00) | |
| Moderate | 27 (60.00) | 9 (20.00) | 9 (20.00) | 45 (100.00) | |
| Total | 240 (68.20) | 58 (16.50) | 54 (15.30) | 352 (100.00) | |

Based on Table 2, the most respondents with hypertension were women as many as 35 respondents (15.20%), the majority category being teenagers was 39 respondents (13.10%), the majority of higher education was 46 respondents (15.00%), the majority not working was 32 respondents (16.40%). Furthermore, the most respondent had less income (45 respondents [15.20%]), the majority of normal weight was 38 respondents (14.90%), with the majority of risky eating patterns as many as 46 respondents (14.90%). The majority lacked exercise (45 respondents [17.30%]). The variables that had a significant relationship with $p < 0.05$ were gender ($p = 0.007$), genetics ($p = 0.000$), age ($p = 0.000$), occupation ($p = 0.030$), and smoking ($p = 0.000$).

Furthermore, for multivariate analysis, the variables included in the analysis wee variables with $p < 0.25$ and several variables that researchers consider essential for further analysis, such as gender, genetics, age, education, occupation, income, weight, diet, exercise, smoking, drinking alcohol, and stress.

Table 3 shows that the variables that were significant for the incidence of prehypertension were genetic variables with $p = 0.043$ and RRR = 2.31. The other variables did not have a significant relationship to the incidence of prehypertension, such as stress, smoking behavior, lack of exercise, risky diet, overweight, low income, occupation, education, age, and gender.

**Table 3: Multivariate analysis of pre-hypertension**

| Normal | RRR (base outcome) | SE | *Z* | p | 95% CI |
|---|---|---|---|---|---|
| Pre-hypertension | | | | | |
| Sex | | | | | |
| Male | 1.862758 | 0.845238 | 1.37 | 0.17 | 0.765453–4.53309 |
| Genetic | | | | | |
| Yes | 2.316784 | 0.960421 | 2.03 | 0.043 | 1.028065–5.22096 |
| Age | | | | | |
| Adults | 1.893457 | 1.327992 | 0.91 | 0.363 | 0.478915–7.486051 |
| Elderly | 5.237638 | 5.240288 | 1.66 | 0.098 | 0.737061–37.21926 |
| Education | | | | | |
| High | 1.722753 | 0.948574 | 0.99 | 0.323 | 0.585516–5.068826 |
| Work | | | | | |
| Not working | 0.726907 | 0.322037 | −0.72 | 0.472 | 0.305054–1.732134 |
| Income | | | | | |
| Less | 0.991956 | 0.450711 | −0.02 | 0.986 | 0.407132–2.41685 |
| Body weight | | | | | |
| Thin | 1.031718 | 0.634158 | 0.05 | 0.959 | 0.309286–3.441615 |
| Overweight | 1.594021 | 0.624118 | 1.19 | 0.234 | 0.739975–3.433766 |
| Eating patterns | | | | | |
| Risk | 0.722812 | 0.339849 | −0.69 | 0.49 | 0.287614–1.816521 |
| Physical exercise | | | | | |
| Less | 1.233861 | 0.452169 | 0.57 | 0.566 | 0.60163–2.53048 |
| Smoke | | | | | |
| Yes | 1.874199 | 0.815161 | 1.44 | 0.149 | 0.79909–4.395778 |
| Drink alcohol | | | | | |
| Yes | 2.91E-07 | 0.000547 | −0.01 | 0.994 | 0 |
| Stress | | | | | |
| Mild | 2.083008 | 0.897357 | 1.7 | 0.088 | 0.895353–4.846046 |
| Moderate | 1.800308 | 0.8588 | 1.23 | 0.218 | 0.706804–4.585587 |
| _Cons | 0.046317 | 0.051575 | −2.76 | 0.006 | 0.005223–0.410747 |

SE: Standard error, CI: Confidence interval, RRR: Relative Risk Reduction.

Table 4 shows that the variables that had a significant relationship with the incidence of hypertension were genetics with $p = 0.000$ and gender with $p = 0.012$. Respondents who had a family history of hypertension had a greater risk of 5.9 times than those without hypertension. The male gender had a risk of 3.68 times compared to female respondents.

**Table 4: Multivariate analysis of hypertension**

| Normal | RRR (base outcome) | SE | *Z* | p | 95% CI |
|---|---|---|---|---|---|
| Hypertension | | | | | |
| Sex | | | | | |
| Male | 3.689879 | 1.912373 | 2.52 | 0.012 | 1.336151–10.18987 |
| Genetic | | | | | |
| Yes | 5.905518 | 2.449866 | 4.28 | 0 | 2.619043–13.31599 |
| Age | | | | | |
| Adults | 1257942 | 5.53E+08 | 0.03 | 0.975 | 0 |
| Elderly | 1.76E+07 | 7.73E+09 | 0.04 | 0.97 | 0 |
| Education | | | | | |
| High | 0.658584 | 0.344523 | −0.8 | 0.425 | 0.236224–1.836108 |
| Work | | | | | |
| Not working | 1.94747 | 1.015495 | 1.28 | 0.201 | 0.700838–5.411577 |
| Income | | | | | |
| Less | 0.811357 | 0.465797 | −0.36 | 0.716 | 0.263355–2.499673 |
| Body weight | | | | | |
| Thin | 0.554229 | 0.418109 | −0.78 | 0.434 | 0.126341–2.431269 |
| Overweight | 1.803613 | 0.767479 | 1.39 | 0.166 | 0.783317–4.152877 |
| Eating patterns | | | | | |
| Risk | 1.237145 | 0.637532 | 0.41 | 0.68 | 0.450583–3.396771 |
| Physical exercise | | | | | |
| Less | 1.825298 | 0.843588 | 1.3 | 0.193 | 0.7378–4.51574 |
| Smoke | | | | | |
| Yes | 0.486648 | 0.281658 | −1.24 | 0.213 | 0.156518–1.513092 |
| Drink alcohol | | | | | |
| Yes | 3.27E-06 | 0.005661 | −0.01 | 0.994 | 0 |
| Stress | | | | | |
| Mild | 1.254503 | 0.718196 | 0.4 | 0.692 | 0.408473–3.85283 |
| Moderate | 1.591125 | 0.834278 | 0.89 | 0.376 | 0.569367–4.446482 |
| _Cons | 3.76E-08 | 1.66E-05 | −0.04 | 0.969 | 0 |

SE: Standard error, CI: Confidence interval, RRR: Relative Risk Reduction.

## Discussion

### *Characteristics and risk factors of hypertension*

The results of the study through a univariate analysis of the characteristics of hypertension risk factors, the highest number was female (231 respondents [65.6%]), not having hypertension (294 respondents [83.5%]), adult age (297 respondents [84.4 %]), higher education (307 respondents [87.2%]), not working (195 respondents [55.4%]), less income (296 respondents [84.1%]). Besides, dominantly, they had normal weight (255 respondents [72.4% ]), risky diet (308 respondents [87.5%]), lacked exercise (260 respondents [73.9%]), not smoking (278 respondents [79%]), did not drink alcohol (350 respondents [99.4%]), did not experience stress (260 respondents [73.9%]). Furthermore, people had hypertension was 54 respondents (15.3%), prehypertension was 58 respondents (16.5%), and normal blood pressure was 240 respondents (68.2%).

These results show that the characteristics based on gender were mostly women, where most of them were homemakers whose daily work was taking care of family needs, raising and educating children, and arranging houses so that the residents always felt comfortable, and these mothers were always around their house. Meanwhile, husbands were often outside the home to earn a living, either as civil servants, civil servants, entrepreneurs, farmers, craftsmen, or herding the livestock they raised. In Kaili culture, a married woman's primary duty and responsibility are to take care of the house and family while the husband's job is to earn a living. This was caused when the researchers took data from most of the mothers that the researchers got, which also caused most respondents not to work. Due to the Kaili

culture, men who work for a living are men (husbands), so women do not feel burdened in terms of income, and most of the women in Kawatuna Urban-Village are always grateful for whatever money their husbands give them. This situation also causes most mothers not to be stressed by the husband's less income; this situation can occur because most mothers in the Kawatuna village have a steady attitude to life and always accompany their husbands in a state of joy or sorrow. The mother has a role as a wife, must have a steady attitude to life, and be able to accompany her husband in all situations accompanied by affection, love, loyalty, and loyalty his life partner. This situation is also following the role of homemakers; the role of homemakers is a character that someone must play according to the position and status that a person has, meaning the role of a housewife is something that a person must play. A housewife depends on the social and cultural conditions that a person owns.

### *Determinants of hypertension proxy in kawatuna urban-village*

The results of the multivariate analysis of the determinants of the prehypertension proxy in the Kawatuna Urban-Village community were caused by genetic factors with p = 0.043 and RRR = 2.31. The determinants of hypertension proxy were caused by genetic factors with p = 0.000 and males with p = 0.012, meaning that families with a history of hypertension had a greater risk of 5.9 times than those without hypertension family. The males had a risk of 3.68 times compared to the females. Regarding genetic factors, polymorphisms of gene loci involved in regulating angiotensin I receptors and aldosterone synthase are at risk of causing hypertension [7]. In a study, in hypertensive patients with Chinese ethnic participants, mutations in the -adducin gene were found that play a role in the enzymatic activity of the Na+/K+/ATPase ion pump related to sodium absorption in the kidneys resulting in increased sensitivity to salt [8].

Increased sensitivity to sodium will cause a defect in kidney sodium homeostasis so that sodium excretion is inadequate, which causes water and salt retention to occur, increasing in plasma volume, which can increase cardiac output, resulting in hypertension. According to Davidson, this study is in line with the theory that if both parents suffer from hypertension, it will decrease in their children by 45%, whereas if one of the parents suffers from hypertension, it will decrease to their children by 30% [9].

An increase in blood pressure over a long period can cause structural changes in blood vessels. Structural changes include changes in macrovascular and microvascular structures. Macrovascular changes in stiff arteries and changes in central to peripheral pressure amplification. Microvascular changes in the form of changes in the ratio of blood vessel walls and lumens in large arterioles, abnormalities of vasomotor tone, and "structural rarefaction" (microvascular loss due to not flowing blood in all microvasculature to maintain perfusion to certain capillaries) [10].

These structural changes will interfere with tissue perfusion. Therefore, target organ damage can occur [10]. Although the body's autoregulation of blood pressure will attempt to maintain blood flow to meet metabolic demands, its ability to regulate blood pressure is decreased in hypertensive patients. Target organs that can be damaged include the heart, kidneys, eyes, and brain [11]. At the same time, males as a proxy determinant of hypertension in the community in Kawatuna Urban-Village is caused by hormonal factors, where men have only a little estrogen hormone, sometimes even none. Various studies have mentioned the benefits of Estrogen to increase immunity from various diseases, including hypertension [12], [13]. Estrogen is believed to prevent plaque formation in the arteries by increasing HDL-High Density Lipoprotein (good cholesterol) and lowering levels of Low Density Lipoprotein (LDL) (bad cholesterol) [14], [15]. Then, the elasticity of blood vessels will remain good as long as there is still the production of the hormone estrogen [16], [17].

In addition to the two proxies above, a risk factor that can also increase the occurrence of hypertension in the community in the Kawatuna village is diet, this can be seen from the results of the analysis of the characteristics of the respondents, it was found that from 352 respondents who had an unhealthy diet as many as 308 respondents (87.5%). This is because the Kawatuna village is an area where the majority of the population is the Kaili tribe. The people of the Kaili tribe have a habit of consuming utakelo food, which is a type of vegetable food made from Moringa leaves cooked using coconut milk. This vegetable is paired with a side dish duo, which is a side dish made from dried salted anchovies cooked with tomato, garlic, onion and rica spices, then sauteed in cooking oil. Both of these menus have become a family favorite and are consumed almost every day. In addition to the utakelo menu, there are also Kaili specialties such as utadada. This menu is a kind of opor with coconut milk soup made from fish or chicken.

All types of food of the Kaili tribe use coconut milk as the basic ingredients. This coconut milk is made from grated coconut meat, then mixed with water and squeezed. Coconut milk contains water, protein, and fat, which is quite high [18] and coconut milk will increase the occurrence of plaque in the blood vessels, which can further lead to hypertension [19]. The pathophysiology of fat metabolism that causes hypertension is started from lipoproteins as lipid carriers circulating in the body and carried into muscle cells, fat, and other cells. Furthermore, triglycerides in the bloodstream are broken down into glycerol and free fatty acids by lipoprotein lipase enzymes located in capillary endothelial cells. Coconut milk contains cholesterol which is abundant in LDL which will accumulate on the walls of blood vessels

and form plaques [20]. Plaque will mix with protein and be covered by muscle cells and calcium which eventually develops into atherosclerosis. Coronary blood vessels suffering from atherosclerosis besides being inelastic, they also experience constriction so that the resistance to blood flow in the coronary arteries also increases, which will trigger hypertension [21].

## Conclusion

Variables that were significant to the incidence of prehypertension were genetic variables with p = 0.043 and RRR = 2.31. Moreover, the variables significantly related to the incidence of hypertension were genetics with a p = 0.000 and gender with a p = 0.012. Respondents who had a family history of hypertension had a greater risk of 5.9 times than those who did not have a family of hypertension. The male gender had a risk of 3.68 times compared to female respondents. The determinants of hypertension proxy in the Kawatuna Urban-Village were genetics and gender.

## References


1. Tan JL, Thakur K. Systolic hypertension. In: StatPearls. Treasure Island, FL: StatPearls Publishing; 2022. Available from: http://www.ncbi.nlm.nih.gov/books/NBK482472 [Last accessed on 2022 Feb 01].
2. Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, Ramirez A, *et al.* International society of hypertension global hypertension practice guidelines. Hypertension. 2020;75(6):1334-57. https://doi.org/10.1161/HYPERTENSIONAHA.120.15026
3. World Health Organization. Noncommunicable Diseases: Risk Factors. Geneva: World Health Organization; 2019. Available from: https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/ncd-risk-factors [Last accessed on 2022 Feb 01].
4. Agency secretariat Balitbangkes. Laporan Riskesdas 2018. Indonesia: Kementerian Kesehatan Republik Indonesia; 2018.
5. World Health Organization. Global Brief on Hypertension. Geneva: World Health Organization; 2013.
6. De Venecia T, Lu M, Figueredo VM. Hypertension in young adults. Postgrad Med. 2016;128(2):201-7. https://doi.org/10.1080/00325481.2016.1147927
   PMid:26821528
7. Lilly LS. Pathophysiology of Heart Disease: A Collaborative Project of Medical Students and Faculty. 5th ed. Baltimore, Maryland: Lippincott Williams and Wilkins; 2010.
8. Wang L, Zheng B, Zhao H, Du P, Sun A, Hua K, *et al.* $\alpha$-Adducin gene G614T polymorphisms in essential hypertension patients with high low density lipoprotein (LDL) levels. Indian J Med Res. 2014;139(2):273-8.
   PMid:24718403
9. Palmer A, Williams B. Simpel Guide Tekanan Darah Tinggi. Jakarta: Erlangga; 2007.
10. Yannoutsos A, Levy BI, Safar ME, Slama G, Blacher J. Pathophysiology of hypertension: Interactions between macro and microvascular alterations through endothelial dysfunction. J Hypertens. 2014;32(2):216-24. https://doi.org/10.1097/HJH.0000000000000021
    PMid:24270179
11. Silverman A, Petersen NH. Physiology, cerebral autoregulation. In: StatPearls, Treasure Island, FL: StatPearls Publishing; 2022. Available from: http://www.ncbi.nlm.nih.gov/books/NBK553183 [Last accessed on 2022 Feb 01].
12. Gubbels Bupp MR, Potluri T, Fink AL, Klein SL. The confluence of sex hormones and aging on immunity. Front Immunol. 2018;9:1269. https://doi.org/10.3389/fimmu.2018.01269
    PMid:29915601
13. Gubbels Bupp MR. Sex, the aging immune system, and chronic disease. Cell Immunol. 2015;294(2):102-10. https://doi.org/10.1016/j.cellimm.2015.02.002
    PMid:25700766
14. Huff T, Boyd B, Jialal I. Physiology, cholesterol. In: StatPearls. Treasure Island, FL: StatPearls Publishing; 2022. Available from: http://www.ncbi.nlm.nih.gov/books/NBK470561 [Last accessed on 2022 Feb 01].
15. Xing D, Nozell S, Chen YF, Hage F, Oparil S. Estrogen and mechanisms of vascular protection. Arterioscler Thromb Vasc Biol. 2009;29(3):289-95. https://doi.org/10.1161/ATVBAHA.108.182279
    PMid:19221203
16. Kabo P. Penyakit Jantung Koroner: Penyakit atau Proses Alamiah. Jakarta: Badan Penerbit Fakultas Kedokteran Universitas Indonesia; 2014.
17. Reslan OM, Khalil RA. Vascular effects of estrogenic menopausal hormone therapy. Rev Recent Clin Trials. 2012;7(1):47-70. https://doi.org/10.2174/157488712799363253
    PMid:21864249
18. Lad VN, Murthy ZV. 4-Natural materials as additives in food emulsions. In: Grumezescu AM, editor. Novel Approaches of Nanotechnology in Food. Vol. 1. United States: Academic Press; 2016. p. 97-132. https://doi.org/10.1016/B978-0-12-804308-0.00004-2
19. Tuminah S, Sihombing M. Frequent coconut milk intake increases the risk of vascular disease in adults. Univ Med. 2015;34(2):149-58. https://doi.org/10.18051/Univmed.2015.v34.149-158
20. Shedden R. Effect of a Coconut Oil Supplement (2g/d) on Total Cholesterol to HDL Cholesterol Ratio in Healthy Adults, Thesis. Arizona: Arizona State University; 2017.
21. Boyette LC, Manna B. Physiology, Myocardial Oxygen Demand. In: StatPearls, Treasure Island, FL: StatPearls Publishing; 2022. Available from: http://www.ncbi.nlm.nih.gov/books/NBK499897 [Last accessed on 2022 Feb 23].